

REMARKS

The Office Action, dated August 13, 2007, has been reviewed and the Examiner's comments carefully considered. Claims 1, 2 and 4-20 are pending in this application, and claims 1, 14, 15 and 17 are in independent form.

Claims 1, 2 and 4-20 stand rejected. Specifically, claims 1, 2, 4, 6-8 and 14 stand rejected under 35 U.S.C. § 103(a) as being obvious over the previously-cited Ward patent in view of U.S. Patent No. 7,123,738 to Mizone and Japanese Patent No. 63187900 to Ono. Claims 9-12 and 15-17 stand rejected under 35 U.S.C. § 103(a) as being obvious over the Ward patent, the Mizone patent, the Ono patent and the previously-cited Kanada publication. Claims 18-20 stand rejected under 35 U.S.C. § 103(a) as being obvious over the Ward patent, the Mizone patent, the Ono patent, the Kanada publication, in further view of the previously-cited Yamaji patent. Further, claim 13 stands rejected under 35 U.S.C. § 103(a) as being obvious over the Ward patent, the Mizone patent and the Ono patent, in further view of the previously-cited Thomas patent. Finally, claim 5 stands rejected under 35 U.S.C. § 103(a) as being obvious over the Ward patent, the Mizone patent and the Ono patent, in further view of the previously-cited Inoue patent and Ogura patent. In summary, the Examiner has withdrawn the use of the '099 publication as a secondary reference in the main rejections, and has instead substituted the combination of the Mizone patent and the Ono patent. In view of the following remarks, Applicants respectfully request reconsideration of these rejections.

Summary of the Invention

According to independent claim 1 of the present application, provided is a loudspeaker diaphragm. This loudspeaker diaphragm includes a base layer having a woven

fabric, and the woven fabric is polyethylene naphthalate fiber impregnated by a thermosetting resin. In addition, the polyethylene naphthalate fiber is an untwisted fiber.

In another embodiment, and as set forth in independent claim 14 of the present application, provided is a loudspeaker including a loudspeaker diaphragm. The diaphragm includes a base layer, which is formed from a woven fabric of polyethylene naphthalate fiber impregnated with a thermosetting resin. The polyethylene naphthalate fiber is an untwisted fiber.

Still further, and in another embodiment set forth in claim 15, provided is a method for manufacturing a loudspeaker diaphragm. This method includes the steps of: impregnating a woven fabric polyethylene naphthalate fiber with a thermosetting resin and curing the thermosetting resin, so as to form a base layer; adding an inactive gas at a super critical state to a molten thermoplastic resin and extruding the mixture of the thermoplastic resin in the inactive gas at the prescribed temperature and pressure, so as to form a thermoplastic resin layer; and laminating the base layer and the thermoplastic resin layer. As discussed above, the polyethylene naphthalate fiber is an untwisted fiber.

In a still further embodiment, and as set forth in independent claim 17 of the present application, provided is a loudspeaker diaphragm. This loudspeaker diaphragm includes a base layer as the outermost layer, as well as a thermoplastic resin layer and a thermoplastic elastomer layer. The base layer includes a woven fabric of polyethylene naphthalate fiber impregnated with a thermosetting resin, and this polyethylene naphthalate fiber is an untwisted fiber.

In response to the previously-outstanding Office Action, Applicants submitted an Amendment modifying the independent claims to specifically indicate that the polyethylene naphthalate fiber is an untwisted fiber. In response, the Examiner again rearranged certain prior art references cited throughout prosecution, and has now added new references in combination to

reject the pending claims. For example, the Examiner uses the Ward patent for its alleged teaching of a base layer of woven fabric impregnated with a thermosetting resin and having a thermoplastic elastomer. The Examiner admits that the Ward patent does not teach or suggest the use of polyethylene naphthalate fiber, where this fiber is untwisted. Next, the Examiner indicates that the Mizone patent teaches the use of polyethylene naphthalate fiber, arguing that the teachings of the Ward patent and the Mizone patent are combinable. Finally, since even these two references together do not include all the alleged features of the independent claims of the present application, the Examiner has added yet another reference, namely the Ono patent. It is the Ono patent that the Examiner indicates provides a diaphragm having a woven base made of an untwisted fiber or roving monofilament. Accordingly, the Examiner uses three references in rejecting independent claims 1 and 14, and four references in rejecting independent claims 15 and 17.

The Cited Prior Art

As discussed, the Examiner has used the Ward patent throughout prosecution of this application, now moving it from a secondary reference to a primary reference and combining it with the newly-cited Mizone patent and Ono patent. The Mizone patent is directed to a loudspeaker, and the Examiner indicates that the Mizone patent teaches the formation of a base layer made from polyethylene naphthalate fiber impregnated with a thermosetting resin, with specific reference to column 1, lines 26-34 of this reference. The Ono patent is directed to a diaphragm for a speaker. The Examiner admits that neither the Ward patent nor the Mizone patent teaches the use of an untwisted fiber, and specifically refers to the Ono patent as including a roving monofilament. For the Examiner's convenience, a complete translated version of the

Ono patent is included for review. Accordingly, the Ono patent should be reviewed (together with the previously-translated abstract) for a better understanding of its teachings.

The Cited Prior Art Does Not Teach or Suggest a Loudspeaker Diaphragm
Having a Base Layer of Woven Fabric of PEN Fiber, Where the PEN Fiber is Untwisted

First, with respect to the Mizone patent, this reference teaches a diaphragm made from polyethylene naphthalate (PEN) with ultra-micro foam. Further, the diaphragm of the Mizone patent is made from only PEN, i.e., 100% PEN, without additional components added thereto. Therefore, the diaphragm set forth in the Mizone patent evidences only the properties of PEN.

The loudspeaker diaphragm of the present invention includes a base layer having a woven fabric of PEN fiber impregnated with a thermosetting resin. Accordingly, the loudspeaker diaphragm of the present invention shows very different physical properties and yields different characteristics than the diaphragm taught by the Mizone patent. For the Examiner's reference, Table A has been included to show the very different properties between the diaphragms of the Mizone patent and the present invention. Again, and as set forth exhaustively throughout prosecution of this application, the loudspeaker diaphragm of the present invention has an excellent balance between a Young's modulus and an internal loss.

TABLE A

| | Mizone (PEN) | Present Invention *** (PEN impregnated with a thermosetting resin) |
|---|---------------------------|--|
| Density (g/cm ³) | 0.33 * | 1.01 |
| Young's modulus (dyne/cm ²) | 1.38 x 10 ⁸ ** | 3.44 x 10 ¹⁰ |
| Internal loss (tan δ) | 0.06* | 0.45 |

* Table 1 of Mizone Patent

** Young's modulus of PEN resin

*** Example 1 of the present invention

Accordingly, and as clearly evidenced in Table A, the properties of the diaphragm of the Mizone patent and the diaphragm of the present invention are quite different. The properties are different since the Mizone patent teaches the use of 100% PEN with ultra micro foam, while the present invention specifically includes a woven fabric of PEN fiber impregnated with a thermosetting resin.

Next, Applicants strongly urge the Examiner to reconsider the combination of the Ward patent and the Mizone patent. The Ward patent only discloses a loudspeaker diaphragm including a base layer having an aramid fiber "KEVLAR" impregnated with a thermosetting melamine resin. Accordingly, the Ward patent does not anywhere teach, suggest or disclose a woven fabric of PEN fiber. In fact, upon further review of the Ward patent, this reference does not investigate the choice of material of resin and/or fiber at all in order to obtain an excellent balance between a Young's modulus and an internal loss. The materials used in the Ward patent (aramid fiber impregnated with melamine resin) and the Mizone patent (100% PEN with ultra micro foam) are not combinable to teach one of ordinary skill in the art to use a woven fabric of PEN fiber impregnated with a thermosetting resin to achieve very specific and beneficial results. "A fact finder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of argument relied upon ex post reasoning." KSR Int'l Co. v. Teleflex, Inc., 127 S. Ct. 1727, 82 USPQ 2d 1385, 1397 (2007).

Applicants find no basis whatsoever in either of the Ward patent and the Mizone patent that would suggest the desirability of experimenting with various different materials, resins and impregnation processes in order to provide a woven fabric of PEN fiber impregnated with thermosetting resin that yields the balanced Young's modulus and internal loss parameters. Reconsideration of the rejections of the independent claims on this basis alone is respectfully requested.

Further, and in addition thereto, the Examiner refers to the Ono patent as teaching the use of an untwisted fiber or roving monofilament. The addition of this third reference shows further use of hindsight reconstruction, where it appears the Examiner is using the claims (and modifications made through prosecution) as an instruction manual or template to piece together the teachings of the prior art in an attempt to render the claimed invention as obvious. The structure of the diaphragm taught in the Ono patent is very different than the structure of the diaphragm of the present invention. As discussed, a translated copy of the Ono patent is provided to the Examiner for further consideration. The Ono patent discloses a speaker diaphragm having a three-layer sandwich structure. Specifically, the three-layer sandwich structure includes: (1) a center material made of a core material; and (2) surface materials made of a fiber-reinforced plastic pasted to two surfaces of the center material. A plain fabric of carbon fiber impregnated with a thermosetting resin is used as a surface material. Such a three-layer sandwich structure is clearly different from the structure of the loudspeaker diaphragm of the present invention, which evidences additional lack of motivation to combine all of these references together. Accordingly, the independent claims of the present invention are additionally patentable and non-obvious over the cited prior art for these reasons.

Summary

In summary, the cited prior art does not teach or suggest a loudspeaker diaphragm having a base layer of woven fabric of a polyethylene naphthalate fiber impregnated with a thermosetting resin, where the polyethylene naphthalate fiber is an untwisted fiber, as set forth in each of independent claims 1, 14, 15 and 17. Further, and as discussed in the previous Amendment filed in response to the last Action, the Examiner has not addressed any of the arguments presented in the Response After Final Rejection of April 9, 2007 in the Advisory

Action. Accordingly, Applicants specifically and again incorporate herein by reference all the arguments made on pages 5-9 of this Response. In particular, and in that Response, Applicants asserted that other factors should be considered with respect to the presently-claimed loudspeaker diaphragm, namely "secondary considerations" that further demonstrate that the claimed invention is not obvious to one skilled in the art. Further, Applicants provided specific experimental results that clearly evidenced new and unexpected results in the form of an improved Young's modulus and internal loss, which result from practicing the present invention. These new and unexpected benefits stem from extensive experimentation and analysis, and Applicants respectfully request that the Examiner take them into consideration.

Further, the Examiner has addressed the suggestion to combine the non-analogous art arguments in paragraph 7 of the Action. Applicants again urge the Examiner to reconsider the combination of these references, as set forth above. One of ordinary skill in the art would not be motivated to combine the Ward, Mizone and Ono patents, and the various components and constituents of the diaphragms disclosed therein, in order to obtain the specifically-claimed woven fabric of PEN fiber impregnated with thermosetting resin, wherein the PEN fiber is an untwisted fiber, as set forth in the independent claims. Further, and as set forth above, considerable experimentation has been conducted to obtain the beneficial characteristics of the loudspeaker diaphragm of the present invention, as specifically discussed above. These "secondary considerations" must be taken into account by the Examiner.

For the foregoing reasons, independent claim 1 is not anticipated by or rendered obvious over any of the cited prior art, whether used alone or in combination. Applicants respectfully submit that there is no hint or suggestion in any of the references cited by the Examiner to combine these references in a manner which would render the invention, as claimed, obvious. Reconsideration of the rejection of independent claim 1 is respectfully requested.

Claims 2-13 and 20 depend either directly or indirectly from and add further limitations to independent claim 1 and are believed to be allowable for the reasons discussed hereinabove in connection with independent claim 1.

For the above reasons, independent claim 14 is not anticipated by or rendered obvious over the prior art of record, whether used alone or in combination. There is no hint or suggestion in any of the references cited by the Examiner to combine these references in a manner which would render the invention, as claimed, obvious. Reconsideration of the rejection of independent claim 14 is respectfully requested.

For the above reasons, independent claim 15 is not anticipated by or rendered obvious over the cited prior art, whether used alone or in combination. There is no hint or suggestion in any of the references cited by the Examiner to combine these references in a manner which would render the invention, as claimed, obvious. Reconsideration of the rejection of independent claim 15 is respectfully requested. Claim 16 depends directly from and adds further limitations to independent claim 15 and is believed to be allowable for the reasons discussed hereinabove in connection with independent claim 15.

Finally, and for the foregoing reasons, independent claim 17 is not anticipated by or rendered obvious over the prior art of record, whether used alone or in combination. There is no hint or suggestion in any of the references cited by the Examiner to combine these references in a manner which would render the invention, as claimed, obvious. Reconsideration of the rejection of independent claim 17 is respectfully requested. Claims 18 and 19 depend either directly or indirectly from and add further limitations to independent claim 17 and are believed to be allowable for the reasons discussed hereinabove in connection with independent claim 17.

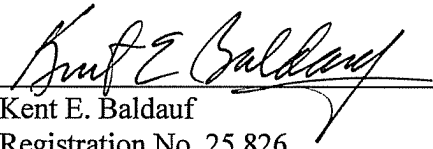
For all the foregoing reasons, Applicants believe that claims 1, 2 and 4-20 are patentable over the cited prior art and in condition for allowance. Reconsideration of the

Application. No. 10/730,162
Paper dated November 19, 2007
Reply to Office Action of August 13, 2007
Attorney Docket No. 4444-032065

present submission in order to move this case towards allowance. Applicants stand ready to interview this case prior to appeal based upon the Examiner's responsive position directed to this Amendment.

Respectfully submitted,

THE WEBB LAW FIRM

By 
Kent E. Baldauf
Registration No. 25,826
Attorney for Applicants
700 Koppers Building
436 Seventh Avenue
Pittsburgh, PA 15219
Telephone: (412) 471-8815
Facsimile: (412) 471-4094
E-mail: webblaw@webblaw.com